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November 8, 2010

Water Docket
Environmental Protection Agency
Mail Code 28221T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Re: Docket ID No. EPA-R03-OW-2010-0736

To Whom It May Concern:

We are submitting these comments on the Draft Total Maximum Daily Load (TMDL) for the Chesapeake Bay as senior leaders within the regional environmental research community. The comments represent neither the formal positions of our institutions, The Chesapeake Bay Program's Science and Technical Advisory Committee, nor the Chesapeake Research Consortium, but our representation of what we are confident are the widely shared views of the involved academic research community concerning the scientific bases for a very important technical element of the Draft TMDL. This element is the modeling tools that comprise the Chesapeake Bay TMDL modeling framework, particularly the Chesapeake Bay Watershed Model and the Chesapeake Bay Water Quality and Sediment Transport Model (hereinafter the Watershed Model and Bay Water Quality Model).

The famous statistician George E.P. Box once wrote: "Essentially, all models are wrong, but some are useful." This essentially sums up the common view of the regional scientific community concerning the Watershed and Bay Water Quality Models. That is, scientists are acutely aware of the many unknowns and uncertainties about the properties, processes and parameters included in the models that limit the accuracy of any model, particularly models of such large and complex ecosystems as the Chesapeake Bay and its watershed. But, are these models useful in setting the direction, amount and distribution of nutrient and sediment load reductions required to achieve the designated water quality criteria? In our judgment, the consensus of the scientific community is that they are both useful and adequate for these purposes.

In this vein, the Draft TMDL acknowledges "the models produce estimates, not perfect forecasts" and "reduce, but do not eliminate, uncertainty in environmental decision making." From the perspective of environmental scientists, it is reassuring that the Draft TMDL notes that "ultimately, the Chesapeake Bay TMDL was based on the overall corroboration of the Chesapeake Bay models, monitoring, and environmental research." Both the Draft TMDL and the component models that underpin it incorporate extensive monitoring data, research outcomes and alternate modeling approaches.

Examples of the extensive incorporation of research outcomes and monitoring data include: empirical regressions of wet deposition that are combined with a continental scale air quality model in the Airshed Model; combining advanced growth allocation models with empirically derived, cellular models in the Land Change Model; reconciliation of the deterministic Watershed Model with the observation-driven SPARROW model; extensive calibration of the Watershed Model with in-stream flow gauging and water quality monitoring, and incorporation of the latest research on turbidity and light limitation of submersed aquatic vegetation in the Criteria Assessment for water quality, to name just a few. It is also recognized

that the monitoring data available for these purposes are of high quality, conforming to rigorous quality assurance/quality control (QA/QC) standards.

The close relationship of this strategic management modeling framework with the research enterprise and monitoring programs will remain critical going forward. Because models are not perfect forecasts they must be verified with real-world observations and improved based on new understanding within an adaptive management framework. The requirement for adaptive implementation of watershed improvement plans designed to achieve TMDLs was eloquently reasoned in the 2001 National Research Council report *Assessing the TMDL Approach to Water Quality Management*. Because the models are regarded as useful and adequate for the purpose, there is no reason to delay moving forward with implementation until they are "perfect," in fact, the models can, at this point, only be improved through this adaptive implementation approach.

We realize that jurisdictions have concerns that load reductions from various management practices are not adequately credited in the allocation of load reductions. However, this is not a failure of the Watershed and Bay Water Quality Models in adequately determining the TMDLs that will achieve water quality standards, but rather a question of the effectiveness of various management practices. The effectiveness of such practices can never be determined simply by the models, but only through demonstration by appropriate monitoring under a range of conditions and pertinent research. In that regard, the models themselves do not demonstrate progress in load reductions or the load reductions still required; these are a function of the assumptions made in the models on management practice effectiveness. If, during the multi-year implementation process, the practices are demonstrated to be effective then the associated greater load reductions can then be credited.

It must also be understood that the models used to develop the Chesapeake Bay TMDL simulate a 10-year hydrologic period from 1991 to 2000. They are strategic models designed to determine annual loads for an average year. They are not designed to assess the loads or effects on water quality for a given year, nor should they be trusted to precisely determine the reduction in loading to the Bay of a specific management practice in a specific part of the watershed. While this strategic approach is very appropriate for the purpose of a TMDL, including subwatershed-scale allocations, more tactical models that are capable of projections for a specific year for comparison to observed water quality conditions would be useful in the adaptive implementation of watershed improvement programs over the next 15 years.

Both the Watershed Model, based on the widely used HSPF model, and the Bay Water Quality Model, based on the CH3D hydrologic transport model combined with a novel eutrophication model, are regarded as state-of-the-art by the community of practice within environmental engineering and management. At least the earlier versions of the Watershed Model are open-sourced models that the Chesapeake Bay Program has made available to interested users and there have been many applications of the model that demonstrate its utility and replicability. The Bay Water Quality Model has more substantial computational requirements that limit access and use by other interested scientists. The Chesapeake Bay scientific community has, however, been developing other, accessible, open-source environmental models to support research and management under the Chesapeake Community Modeling Program (CCMP). In general, these models have produced similar results for projections of water quality as a function of nutrient loading, lending confidence to the use of the Bay Water Quality Model.

Particularly through the Chesapeake Bay Program's Scientific and Technical Review Committee (STAC), experts in both the regional and national scientific and engineering communities have been regularly engaged in peer review of component models or critical assumptions of these models. In fact, the Bay Program has consistently sought external review from the larger scientific community on model components, as well as comprehensive reviews of the model structure. The following STAC peer reviews available on its website http://www.chesapeake.org/stac/stacpubs.html#RR include:

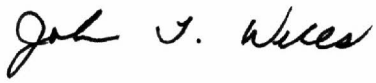
- Review of Land-Use and Land-Cover Dataset and Methodology (September 2010)

- Review of Water Clarity and SAV Components of the Chesapeake Bay Program Water Quality and Sediment Transport Model (March 2010)
- Chesapeake Bay Land Change Model Review (November 2008)
- Chesapeake Bay Watershed Model Phase V Review (February 2007)
- Requested Review of Procedures of the UMD/MAWP Best Practice Project Year 2 (November 2008)
- Review of the Chesapeake Bay Watershed Modeling Effort (June 2005)
- Review of Draft Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Tidal Tributaries (July 2002)
- Review of the Chesapeake Bay Water Quality Model (February 2000)

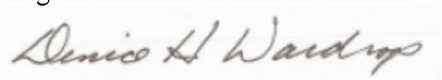
Some of these reviews have been very critical of the models or their assumptions; however, these criticisms should be considered as part of the scientific process of rigorous review and recommendations for improvement. Nonetheless, we believe that the substantial majority of knowledgeable environmental scientists in the region agrees with the premise that the modeling framework used to develop the Draft TMDL represents the best current incorporation of available science with which to set and allocate maximum loads within the watershed.

Sincerely yours,

Donald F. Boesch, President
University of Maryland Center for Environmental Science



John Wells, Dean and Director
Virginia Institute of Marine Science



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